APPENDIX L

FISH PASSAGE SUMMARY

FISH PASSAGE CENTER

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Michael B. White, P.E.
Director, Civil Works and Management
U.S. Army Corps of Engineers
Northwestern Division
PO Box 2870
Portland, OR 97208-2870

Dear Mr. White,

As per your request we are providing both you and Dr. Mark Schneider of NOAA Fisheries with a copy of our "Gas Bubble Trauma Monitoring and Data Reporting for 2003". This report summarizes data collected during the 2003 juvenile salmonid migration.

Please feel free to contact us if you require any additional information.

Sincerely,

Michele DeHart
Fish Passage Center Manager

CC: David Ponganis, COE
Jim Adams, COE
Dr. Mark Schneider, NOAA

Gas Bubble Trauma Monitoring and Data Reporting for 2003

Overview

Monitoring of juvenile salmonids in 2003 for signs of gas bubble trauma (GBT) was conducted at Bonneville Dam and McNary Dam on the Lower-Columbia River, and at Rock Island Dam on the Mid-Columbia River. The Snake River monitoring sites were Lower Monumental Dam, Little Goose Dam, and Lower Granite Dam. Sampling of fish began the first full week of April at all sites and continued through mid-June at the Snake River sites, when the numbers of steelhead and yearling chinook were too few to sample effectively. Subyearling chinook were not sampled in the Lower Snake River due to their endangered status and because the Biological Opinion does not call for the implementation of summer spill at the Snake River collector projects. Sampling of subyearling chinook did occur at Columbia River sites to the end of August.

Sampling occurred two days per week at the Lower Columbia sites and once a week at Lower Granite, Little Goose and Lower Monumental in the Snake River. In previous years fish were sampled every other day (3 to 4 days per week) at most facilities. The number of sampling days was reduced in 1999, in order to decrease the number of fish handled. It was determined that the reduced sampling effort would not significantly diminish the capability to detect the presence of GBT in the migrating population.

The goal was to sample 100 salmonids of the most prevalent species (limited to chinook and steelhead) during each day of sampling at each site, the proportion of each species dependent upon their prevalence at the time of sampling. Examinations of fish were done using variable magnification (6x to 40x) dissecting scopes. The eyes, and unpaired fins were examined for the presence of bubbles. The bubbles present in the fins were quantified using a ranking system based on the percent area of the fins covered with bubbles. A rank of 0 was recorded when no bubbles were present; rank 1 was recorded when up to 5% of a fin area was covered with bubbles; rank 2 was for 6% to 25%; rank 3 indicated 26% to 50% fin area was bubbled; and rank 4 indicated greater than 50% of a fin was covered with bubbles. The eyes of the fish were also examined and the eye with the highest amount of bubbles in it was ranked using the same criteria as was used for the fins. Additional information was recorded for each fish including, species, age, race,

rearing disposition, fork length, fin clips, and tags. The examination procedures were similar to those used in past years of the program (see the GBT Monitoring Protocol for details of exam procedures).

Sampling techniques varied somewhat based on the location. This year all sampling sites were at dams, where fish could be collected from the juvenile fish bypass system. At those dams where fish crossed separators the fish were collected as they entered the separator. Rock Island Dam is the only site where fish were held in a tank (up to 24 hours) prior to examination.

Results

A total of 12,420 juvenile salmonids were examined for GBT between April and August (Table I). A total of 104 or 0.8% showed some signs of GBT in fins or eyes (Table

Table 1. Number of juvenile salmonids examined for signs of GBT at dams on the Lower Snake River and on the Columbia River from April to August 2003 as part of the GBT Monitoring Program.

	Site						
Species	**BON**	**MCN**	**LMN**	**LGS**	**LGR**	**RIS**	**Total**
Chinook Subyearlings	1,731	2,173				1,007	4,911
Chinook Yearlings	1,324	1,330	408	539	424	659	4,684
Steelhead	256	248	548	455	676	642	2,825
Total	**3,311**	**3,751**	**956**	**994**	**1,100**	**2,308**	**12,420**

2). Fin signs were found in 101 or 0.8% of the fish sampled at all sites. No fish were found with severe fin signs (rank 3 or higher) while, 5 fish had fin rank 2, with the remainder (96 having rank 1 signs). The prevalence of GBT signs at Rock Island Dam was higher than any other Columbia River site during the 2003 monitoring season as is typically the case each season. Because the Rock Island data may obscure other inter-annual trends in the occurrence of GBT signs among sites, it will be treated separately in the remainder of this report.

Table 2. Number of juvenile salmonids found with fin GBT at dams on the Lower Snake River and on the Columbia River from April to August 2003 as part of the GBT Monitoring Program.

Species	Site						
	BON	**MCN**	**LMN**	**LGS**	**LGR**	**RIS**	**Total**
Chinook Subyearlings	0	0	N/A	N/A	N/A	20	20
Chinook Yearlings	0	3	1	5	0	17	26
Steelhead	0	1	28	13	0	13	55
Total	**0**	**4**	**29**	**18**	**0**	**50**	**101**

At the Lower Columbia River and Snake River sites (i.e. excluding Rock Island) a total of 10,112 fish were examined with 54 (0.5%) exhibiting signs of GBT, compared to 0.7% in 2002, 0.1% in 2001, 0.2% in 2000, 1.4% in 1999, 1.6% in 1998, 4.3% in 1997, 4.2% in 1996 and 1.3% in 1995. Fifty-one fish were found with fin signs in 2003 (0.5%), comparable to 1999 when 0.3% were found with fin signs. The percent signs over the past several years has been 0.7% in 2002, 0.001% in 2001, 0.2% in 2000, 0.3% in 1999, 1.0% in 1998, 3.2% in 1997 and 3.3% in 1996. No fish were found with severe fin GBT in Lower Snake and Lower Columbia sampling. This is similar to 2002, 2001, 2000, 1999, and 1995 when no severe fin GBT was found. Other years showed higher incidence of severe fin GBT; in 1998 four (0.01%) fish displayed severe fin signs, 1997 when 117 fish (0.27%) had severe fin signs (again excluding Rock Island) and 47 fish (0.12%) in 1996.

The Biological Opinion Spill Program was managed using the data collected for total dissolved gas levels. However, signs of GBT in fins of juvenile fish, examined as part of the biological monitoring, were used to compliment the physical monitoring program. The NMFS set the action criteria for the biological monitoring program at 15% prevalence of fish having fin signs **or** 5% with severe signs (rank 3 or greater) in fins. The NMFS action criteria were never exceeded. This is similar to 2002, 2001, 2000, 1999, 1998 or 1995 when no exceedences occurred. But contrasts with 23 dates when GBT levels surpassed the action criteria in 1997, 20 in 1996.

The prevalence and severity of fin signs in juvenile salmonids sampled in the Lower Snake and Lower Columbia rivers reflects changes in TDGS conditions in the

river from year to year. The occurrence of severe signs in 1996 and 1997, and the increase in exceedences of the NMFS action criteria, reflected a significant increase in the number of days when TDGS rose above 125% in the forebays of these dams (see Tables 3 and 4). In other years few fish were observed with severe signs of GBT reflecting the more moderate conditions found in the river.

Discussion

This year, as in previous years, the proportion of fish showing fin signs appears to be proportional to the levels of TDGS experienced by fish. Lower Monumental Dam was the only location in the Lower Snake and Lower Columbia where signs of GBT approached the NMFS action criteria, when on June 2 and June 9, 10 and 7 of 100 fish examined (respectively) were found with fin GBT. It is also the location, along with Little Goose with the greatest number of days when TDGS exceeded 120% at the forebay monitor (Table 4). These two sites showed the highest number of fish with fin signs in 2003, with 29 fish found with signs at Lower Monumental and 18 at Little Goose (Table 2). The incidence of signs was related to a spike in flows exceeding 200 kcfs that occurred around May 31 that was accompanied by high spill levels and consequently high TDGS levels in the Lower Snake River. Most of the fish affected were steelhead.

Table 3. The number of days when TDGS levels were above 120% and 125% at representative forebay monitors in the Lower Snake and Lower Columbia Rivers from April 1 to August 31.

	2003		2002		2001		2000		1999		1998		1997	
TDGS Monitor	**days >120**	**days >125**	**days >120**	**days >125**	**days >120**	**days >125**	**days >120**	**days >125**	**days >120**	**days > 125**	**days >120**	**days >125**	**days >120**	**days >125**
Lower Granite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Goose	7	2	1	0	0	0	0	0	5	0	8	3	23	8
Lower Monumental	7	2	5	0	0	0	0	0	7	2	14	8	61	31
Ice Harbor	4	0	0	0	0	0	1	0	5	1	14	4	52	19
McNary (Oregon)[a]	1	1	0	0	0	0	0	0	3	0	0	0	46	0
John Day	1	1	0	0	0	0	0	0	0	0	7	0	47	15
Bonneville	0	0	0	0	0	0	0	0	0	0	3	0	65	27
Total	**20**	**6**	**6**	**0**	**0**	**0**	**1**	**0**	**20**	**3**	**46**	**16**	**294**	**100**

[a] 2002 data used Washington monitor at McNary due to missing data from Oregon monitor during July and August.

Table 4. The number of days when NMFS GBT criteria of 15% prevalence or 5% severe signs were exceeded at sites in the Lower Snake and Lower Columbia rivers from April 1 to August 31.[ab]

Site	2003	2002	2001	2000	1999	1998	1997
Lower Granite	0	0	0	0	0	0	0
Little Goose	0	0	0	0	0	0	1
Lower Monumental	0	2	0	0	0	0	7
Ice Harbor	0	0	0	0	0	0	3
McNary	0	0	0	0	0	0	2
John Day	0	0	0	0	0	0	1
Bonneville	0	0	0	0	0	0	11
Total	**0**	**2**	**0**	**0**	**0**	**0**	**25**

[a] Based on dates when at least 30 fish of the species exhibiting signs were captured.
[b] More than 5% of fish showed severe signs on only 1 date in each year 1996 & 1997 and on those same dates the prevalence of fin signs was greater than 15%.